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W.A. Kalender: Computed tomography: fundamentals, system technology, image quality, applications (with CD-ROM)

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W.A. Kalender, the author of this volume, is probably the scientist who, as an individual and with his team, has contributed the most to the technical development of CT from the early 1980s into the new century. A well-known refresher-course speaker, he is therefore especially qualified to summarize the current state of the art and upcoming future developments of this important imaging technique which has resisted all the advantages of MRI and is still increasing its clinical applications.

After a historical perspective, the volume starts with the basics and the physical principle of measurement and CT image reconstruction. All major development steps were primarily undertaken to shorten image

acquisition, such as the transition from the first and second to the third and fourth generations in the 1970s, the introduction of spiral volume scanning in the late 1980s and of multi-row-detector systems in the late 1990s. The last step simultaneously has enabled isotropic imaging, i.e. a similar resolution in all three dimensions of the space.

Important components and measurement modes of standard scanners are presented and discussed in detail, clearly and in a fashion that is easily understandable. Special issues, such as spiral CT, image quality, dose, image analysis and post-processing, as well as special applications, are then covered in dedicated chapters. Spiral CT not only includes the basic change from a two-dimensional to a three-dimensional approach, but also the principles of z-axis interpolation and of z-axis filtering, as used in multi-row-detector systems. Image quality is represented by numerous parameters such as noise, geometric and contrast resolution, slice sensitivity profile and artefacts. The chapter about dose presents updated knowledge about exposure both to the patient and to the personnel with the specifics of spiral CT and some helpful general statements. Due to the improved, often nearly isotropic geometric resolution with a significantly increased amount of data and images per study, image analysis and post-processing have become very important components of a CT examination. Two-dimensional reformation (some centers use reformatted coronal images for routine analysis) and 3D presentation techniques (surface-shaded

display, intensity-based projections, volume rendering and virtual endoscopy) have become routine tools. A CD-ROM included in the book interactively illustrates image analysis and post-processing. Applications receiving a dedicated mentioning include quantitative CT and cardiac CT, as used for coronary calcium screening and for phase selective cardiac imaging. Even after the current implementation of multi-row-detector systems into clinical use, the future of CT promises to be bright: multi-row-detectors will be replaced by area detectors, allowing still faster volumetric measurement. Another important issue will be the control of radiation exposure by interactive tube-current modulation according to the cross-sectional geometry of the patient, and this might be extended to an automatic exposure control for all types of CT examinations, based on a defined signal-to-noise ratio.

In conclusion, this volume which was published in English and in German language, with a minimum of mathematical formulas, is easily readable and can be recommended both to radiologists and to other professionals interested in and involved with CT scanning. Its availability in the libraries of all training institutions is a must, and it is an ideal base for the radiologist to understand his increasing responsibility of directing patients to the best imaging procedure, using an optimized CT protocol that respects both image quality and dose.

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